

Solar System

If Kevin starts with the solar system, ask if the students can identify what they are looking at. Ask “what is a solar system” (a single star and the planets around that star). See if they can come up with a definition for planet – the only two things that astronomers agree on right now is: 1) a planet orbits a star and 2) a planet is round. Ask how many planets in our solar system – as of Dec '09, there are 13: 8 major planets and 5 minor planets (sometimes called dwarf planets).

Have Kevin jump or fly to Mercury. Mercury looks very much like our Moon – it is a rocky planet that has been bombarded by meteoroids and other space debris. It gets very hot on the sun-side and extremely cold on the dark-side. It takes 88 days to orbit the Sun and 55 days to rotate.

Fly to Venus next. Venus is just a bit smaller than Earth, but covered in a thick layer of clouds that are composed of carbon dioxide, carbon monoxide, ammonia, and sulfur dioxide – all poisonous to us. The thick clouds trap the Sun’s heat at the surface making Venus a balmy 900 degrees Fahrenheit all day and night. Venus orbits the Sun every 225 days but takes 245 days to rotate. It rotates backward (we see the Sun rise in the east and set in the west, on Venus it would appear to rise in the west and set in the east). It is thought that between 2 and 3 billion years ago, something probably larger than Mars slammed into Venus.

The third planet from the Sun is Earth. Approaching Earth, you notice the blue water which covers 78% of our planet. So far it is the only planet that we’ve found with liquid water. A) Take a look at the landforms around the globe. Or B) have Kevin fly to the ground and look at the night sky. Venus is in the west above the setting Sun, it is the brightest object in the night sky (except the Full Moon). Straight up is Saturn, looking like a bright golden star. Between those 2 planets, closer to the top of the sky, is a backward question mark that marks the head and front leg of Leo the Lion. The pair of stars above Venus is the Twins (Gemini). Near Leo you may be able to spot tiny red Mars. Kevin can put up the lines for constellations and then add in the full pictures.

The 4th planet is Mars. The red color is from iron oxide (rust) in the soil. You know to form rust iron bearing rocks need to be exposed to oxygen and water, but is there water on Mars? The thin atmosphere of Mars is mostly carbon dioxide. There is water but it’s frozen under the surface and at the poles. During the day the temperature reaches 82 degrees, but at night the temperature drops to -157 degrees. Looking at the surface of Mars we can see dry river beds, oceans and lakes – Mars had water on the surface many hundreds of millions of years ago. The largest volcano in our solar system is on Mars – Olympus Mons is 3 times taller than Mt. Everest. Many scientists believe that Mars’ two moons are really captured asteroids. Kevin can bring up one of the moons – look at it – is it round? More like a baked potato. Nearly all the asteroids in the Asteroid Belt look like this moon, except for one – Ceres, the largest asteroid. Have Kevin bring up Ceres. You’ll notice that it is round, although Ceres is only about the size of Texas. Ceres was discovered in 1801 and was classified as a planet until 1820 when more asteroids were discovered and Ceres was demoted. Mars takes 687 days to orbit and rotates in just over 24 hours.

Right now we've looked at 4 of our major planets – the terrestrial or rocky planets – Mercury, Venus, Earth, and Mars – and little minor planet Ceres.

Next we turn to the gas giants. The largest planet in our solar system is Jupiter. Jupiter is composed of hydrogen and helium, just like the Sun – but neither Jupiter nor Saturn (which is also made of hydrogen and helium) are stars because they are too small. If Jupiter were around 15X bigger it would be a star. Most people recognize the Red Spot – this is basically a huge hurricane that is over 400 years old. You could fit 3 Earths across the Spot. The Spot was seen by Galileo through his early telescope as were the 4 largest of Jupiter's nearly 90 moons. Two of those moons are larger than Mercury, but the third which is about the size of Mercury is Europa. Europa is made of water. It is covered by a 15 mile layer of ice, yet the center is liquid because of the gravity of Jupiter. Could this be somewhere we should search for life? Jupiter takes about 17 years to orbit, yet rotates every 10 hours.

The next gas giant is Saturn, which is known by the big beautiful rings that surround it. All the gas giants have rings, Jupiter and Neptune only have a few small wispy rings. The rings are made of ice chunks and small rocks – the largest pieces are the size of Mini-Cooper cars. Most of Saturn's moons are small, but it has one larger than Mercury. Titan has been explored by the Cassini mission and the probe Huygens. Huygens discovered that Titan has continents and oceans, but the oceans, rivers and lakes of Titan are actually liquid methane. Methane on Earth is a gas, but Titan is so cold that the gas has turned to liquid. On Earth, methane is used by some organisms instead of oxygen. Is this another place we should look for life? Saturn also has an ice moon, Enceladus, that astronomers want a closer look at. Saturn takes 29 years to orbit.

The third gas giant is Uranus. It would have solved a lot of problems if William Herschel who discovered it in 1781 had had his way. He wanted to call the planet George – after his patron, King George the third. But the astronomers wanted to keep with the Roman mythology. Uranus is the grandfather of Jupiter. You will note that it also has a really nice ring system and about 13 moons. The blue color is methane gas.

Our last gas giant is Neptune. It is the smallest of the gas giants and also made of methane gas. It's largest moon, Triton, looks very much like objects farther out in our solar system – like Pluto. Neptune takes 167 years to orbit.

Beyond the gas giants is the Kuiper (K-eye/per) Belt. This area of space is home to Pluto. Pluto was discovered in 1930 by Clyde Tombaugh and was thought to be the size of Mercury. In 1978, we learned that Pluto was smaller than our Moon and had its own moon Charon which is 1/3 the size of its planet. Pluto's surface is frozen methane (the red) and rocks and carbon dioxide and ammonia ices (the white parts). There is a mission called New Horizons on its way to take pictures of Pluto – it will arrive in 2014. It was launched in 2006 and is moving faster* than anything we've ever built. Pluto takes nearly 250 years to orbit the Sun.

In 2003, a young man discovered an object slightly larger than Pluto with its own moon farther away from the Sun. He came to the International Astronomers Union in 2006 to have his planet named as the 10th planet. But because Pluto and this new planet now named Eris are smaller than our Moon they

were designated minor planets or dwarf planets. In 2009, two more were discovered in between Pluto and Eris. They were named Ha-oo-may-a (actually spelled Haumea) named for the Hawaiian goddess of creation and Ma-kay-ma-kay (spelled Makemake) named for the Polynesian god of the sea.

At this time there is the possibility of 4 more minor planets being added in the next year or two – they will be named for Inuit (Eskimo) mythology and Hindu mythology.

Kevin can fly us out of our solar system and outside of our galaxy – the Milky Way. The Milky Way is a spiral galaxy and our Sun is out on the edge of the galaxy – to get from our sun to the center of our Milky Way would take 30,000 years if we could travel 186,000 miles a second (the speed of light).

*Voyager is actually traveling very quickly now, having been boosted by particularly Jupiter, and they are both beyond the orbit of Pluto. We probably won't get any more transmissions from